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EVIDENCE OF A BANK LENDING CHANNEL FOR ARGENTINA AND COLOMBIA^{*}

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In this paper we find empirical evidence of bank lending channel for Colombia and Argentina. For Argentina, we do not find evidence that changes in the interbank interest rate affect the growth rate of total loans directly. However, the interbank interest rate affects the loan supply through its interactions with capitalization and liquidity. For Colombia, there is direct bank lending channel, which is reinforced through interactions with capitalization and liquidity. Also, using a panel data of more than 3,300 firms, we provide additional support to the existence of a bank lending channel for Colombia.

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1. INTRODUCTION

While economists agree that monetary policy can affect real output in the short run, there is still a lot of controversy on how does monetary policy exactly operate.

The most commonly discussed channel, the traditional interest rate channel, suggests that when the Fed decreases money supply (exchanging bonds for bank reserves), nominal and real interest rates will increase –the effect of monetary policy on the real interest rates works through an assumption of sticky prices in the short run. Consequently, investment and present consumption decrease, and therefore aggregate demand (AD) decreases. However, as Bernanke and Gertler (1995) point out, empirical studies of the interest rate channel have

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not been entirely successful in explaining large changes in GDP and AD components due to moderate changes in the interest rates induced by monetary policy. These empirical findings have led to a vast literature that tries to identify and quantify other monetary transmission mechanisms, which complement and amplify the interest rate channel.

A long-standing question is whether financial institutions in general, and banks in particular, play an important role in the transmission of monetary policy to the real economy. The literature identifies two channels in which financial institutions might play a significant role, namely, the balance sheet channel (or broad credit channel) and the bank lending channel (or narrow credit channel).

The balance sheet channel was first introduced by Bernanke and Gertler (1989). The main idea of this mechanism is that in the presence of imperfect capital markets, informational asymmetries between borrowers and lenders cause a gap in the cost of internal and external sources of funding to borrowers. In general, this gap has a negative relation with the collateral of the borrower. A contractionary monetary policy has the effect of increasing real interest rates, therefore reducing the value of assets that act as collateral, which has the effect of deteriorating credit worthiness of borrowers. Therefore, consumption and investment plans that would be profitable if financed entirely with internal sources of funding are no longer profitable when financed partially with external sources. This effect leads to a lower level of AD in the economy, magnifying the effects of the interest rate channel. Note that there is no specific role played by banks in the broad credit channel.

On the other hand, the bank lending channel gives a specific role to banks. The basic idea is that a contractionary monetary policy that reduces bank deposits creates a need for alternative funds in order to maintain the level of loans. If such alternative funds are scarce or not available, then banks will necessarily reduce their loan supply, affecting negatively consumption and investment plans. Therefore, the bank lending channel amplifies the effect on AD of a contractionary monetary policy.

In order to have a bank lending channel two conditions are required: first, some firms must be dependent on bank loans; second, the central bank must be able to shift bank loan supply schedules. Regarding the first condition, there is evidence that suggests that small firms are bank dependent¹. This occurs because banks have a comparative advantage in the sense of having lower costs of obtaining information about (and monitoring) their customers than other investors. Also, small firms generally lack access to securities markets. This effect will be more important for countries with less developed capital markets.

With respect to the second condition, a contractionary monetary policy has the effect of reducing the aggregate level of deposits². Since these are one of

¹ For US, see for example Fazzari *et al.* (1988).

² Bernanke and Blinder (1992) show that aggregate deposit fall immediately when the Fed tightens monetary policy. Using bank disaggregated data, Kashyap and Stein (1995) also provide evidence that supports this.

the least expensive sources of financing for banks, it will be costly (for some banks) and even impossible (for others)³ to offset the shortage in deposits with other sources of funding. In particular, if the Modigliani-Miller financial irrelevance theorem (Modigliani and Miller, 1958) does not hold for the banking firm, some banks will not be able to obtain loanable funds required to maintain their level of lending, and therefore their loan supply will drop⁴. Then financial variables that measure banks' financial health can play an important role, in the sense that banks with weak balance sheets are more affected by informational asymmetries than banks with stronger balance sheets.

In this paper, we look for evidence consistent with the bank lending channel literature for Argentina and Colombia. We find evidence that supports the existence of a lending channel of monetary policy for Colombia, but there does not seem to exist a strong evidence of a bank lending channel for Argentina. We do not find evidence that changes in the interbank interest rate affect the growth rate of total loans directly in Argentina. However, it does indirectly through interactions: the interbank interest rate affects the loan supply through its interactions with capitalization and liquidity. As for Colombia, there is direct bank lending channel, which is reinforced through interactions with capitalization and liquidity. Also, using a panel data of more than 3300 Colombian firms, we provide additional support to the existence of a bank lending channel for Colombia.

The rest of the paper is organized as follows. Section 2 presents a theoretical model developed by Kishan and Opiela (2000), which has testable implications for the empirical analysis. Section 3 discusses the data and summary statistics and evidence of a bank lending channel for other countries that has been established in other's work. Section 4 presents the empirical analysis and results, and Section 5 concludes.

2. A MOTIVATING MODEL

Kishan and Opiela (2000) provide evidence of the existence of a bank lending channel of monetary policy in the US from 1980 to 1995. Following

³ Because demand deposits are insured, they are less subject to informational asymmetries relative to other sources of funding (i.e. large time deposits). Meanwhile, other sources of funding for banks are uninsured, which makes them more likely to suffer information problems. Therefore, bank characteristics that are not so important for the obtention of deposits become very relevant for the acquisition of other sources of funds, such as large CDs.

⁴ Another way in which a contractionary monetary policy can affect bank lending is through its impact on the capitalization ratio. Banks face interest rate risk given their role in maturity transformation: they hold long term assets (many of them with a fixed interest rate), which they finance issuing short term liabilities. Therefore, a contractionary monetary policy, which increases short-term interest rates, increases the debt of the banks and decreases the net present value of its assets, thus reducing bank profits. If banks cannot reduce dividend payments substantially, then equity is reduced. Given the minimum capitalization requirements, some banks that initially had a low capitalization ratio, will have to cut lending to meet the capitalization requirement as a short term response.

Kashyap and Stein (1995), they try to identify the bank lending channel by studying cross sectional differences on the response of bank lending to monetary policy. To do so, they develop a model of a representative bank that has three assets, namely required reserves (RR), loans (LN) and securities (SEC); and three liabilities, namely, demand deposits (DD), large time deposits (TD) and capital (K). For simplicity, the bank does not hold excess reserves, so $RR = \alpha DD$, where $\alpha \in [0,1]$ is determined by the central bank.

DD are assumed to be inversely related to the Fed funds rate: $DD = a_0 - a_1 r_{ff}$. A bank is assumed to have market power in the TD market as well as in the LN market. Thus, it can raise TD by increasing its rate (r_{TD}) over the mean rate in the market ($\overline{r_{TD}}$), and can change loans by moving its loan rate (r_{LN}) with respect to the mean rate in the loan market ($\overline{r_{LN}}$):

$$(1) \quad TD = b_0 + b_1(r_{TD} - \overline{r_{TD}})$$

$$(2) \quad LN = d_0 - d_1(r_{LN} - \overline{r_{LN}})$$

Capital markets are assumed to be imperfect. This is introduced by assuming that the interest rate sensitivities of TD and LN respectively (b_1, d_1) > 0 , depend on bank size and capitalization. Specifically, it is assumed that b_1 depends positively on both bank size and capitalization, following the idea that larger and better capitalized banks will find it easier to raise funds by issuing time deposits. Meanwhile, d_1 depends positively on bank size only, reflecting the idea that larger banks tend to give credit to larger firms which have better access to alternative sources of funding. Thus, larger banks have a demand for LN which is more sensible to changes in the interest rate than that of small banks⁵.

$$(3) \quad b_1 = b_1^+(A, K)$$

$$(4) \quad d_1 = d_1^+(A)$$

Securities are held as a buffer stock against liquidity shocks, and the mean market rates of TD , SEC and LN are assumed to be directly related to the Fed funds rate with fixed spreads:

$$(5) \quad SEC = c_0 + c_1 DD - RR$$

$$(6) \quad \overline{r_{TD}} = e_0 + \phi r_{ff}$$

$$(7) \quad \overline{r_{SEC}} = f_0 + \phi r_{ff}$$

$$(8) \quad \overline{r_{LN}} = g_0 + \phi r_{ff}$$

⁵ Kishan and Opiela (2000) assume that while large banks can also attend small firms, their major clients are large firms with access to capital markets.

Banks are assumed to choose LN , TD and SEC to maximize profits,

$$(9) \quad Profit = (\overline{r_{LN}} - \Phi)LN + \overline{r_{SEC}}SEC - \overline{r_{DD}}DD - \overline{r_{TD}}TD$$

subject to the balance sheet constraint ($LN + SEC + RR = DD + TD + K$) and the equations given above. ΦLN represents loan losses.

The first order conditions of this maximization problem yield the optimal portfolio for the bank (i.e., LN , SEC , TD). Taking derivatives of LN , SEC and TD with respect to the Fed funds rate generates some testable implications. In particular, assuming $c_1 < 1$, the model predicts that an increase in this rate should increase TD , decrease LN , and have an ambiguous effect on SEC (the sign of the partial derivative will depend on the values of the parameters, thus becoming an empirical issue).

$$(10) \quad \frac{\partial LN}{\partial r_{ff}} = -\frac{a_1 d_1 (1 - c_1)}{b_1 + d_1} < 0$$

$$(11) \quad \frac{\partial TD}{\partial r_{ff}} = \frac{a_1 b_1 (1 - c_1)}{b_1 + d_1} > 0$$

$$(12) \quad \frac{\partial SEC}{\partial r_{ff}} = -a_1 (c_1 - \alpha) \leq 0$$

More interesting testable implications, however, derive from the introduction of the dependence of interest rate sensitivities of LC and TD on bank size and capitalization:

$$(13) \quad \frac{\partial(\frac{\partial LN}{\partial r_{ff}})}{\partial A} = \frac{\partial(\frac{\partial TD}{\partial r_{ff}})}{\partial A} = \frac{a_1 (1 - c_1) (b_1 \frac{\partial d_1}{\partial A} - d_1 \frac{\partial b_1}{\partial A})}{(b_1 + d_1)^2} \leq 0$$

$$(14) \quad \frac{\partial(\frac{\partial LN}{\partial r_{ff}})}{\partial K} = \frac{\partial(\frac{\partial TD}{\partial r_{ff}})}{\partial K} = \frac{a_1 d_1 (1 - c_1) \frac{\partial b_1}{\partial K}}{(b_1 + d_1)^2} > 0$$

First, the net effect of asset size on the sensitivity of LN to r_{ff} is undetermined and depends on parameter values. This reflects the idea that two factors play an important role for big banks: maybe they may face less asymmetries of information than smaller banks, and therefore they can obtain easier alternative sources of funds (TD) when a contractionary monetary policy reduces DD ; but, their clients are also bigger firms which tend to be more sensitive to interest rates, so if big banks increase r_{LN} due to higher costs of funding, they will loose more demand for loans than smaller banks. Similarly, it is unclear the effect of bank size on the sensitivity of TD to the Fed funds rate.

Furthermore, the sensitivity of LN to r_{ff} is lower for better capitalized banks; that is, better capitalized banks experience a lower reduction in loans than

less well capitalized banks do. Similarly, better capitalized banks will increase more TD in times of monetary policy tightening.

Thus, capitalization and bank size appear to matter for lending. In Section 4 we test the predictions for bank lending that derive from this model for Argentina and Colombia.

3. DATA

3.1 Data sources

The data for banks of Argentina are taken from the *Información de Entidades Financieras* releases of the Central Bank of Argentina, which consists of the monthly balance sheets that each bank is required to report to the *Superintendencia de Entidades Financieras y Cambiarias* (the financial institutions' regulator). The period used is 2003:08 to 2005:11, that is after the 2001-2002 crisis. Unfortunately, such releases only include those banks that existed as of November 2005; therefore, banks that disappeared throughout the period are not included in the dataset.

The data for banks of Colombia comes from financial statements that banks report monthly to the *Superintendencia Financiera de Colombia*, which regulates the financial system. The sample used covers the period 1995:1 to 2005:9, and consists of all the commercial banks that were operating at every moment of time. The panel of banks is unbalanced, with a maximum number of 40 banks in 1997:12, and a minimum of 21 banks at the final period. The number of banks at the beginning of the sample period was 38. The reduction in the number of banks during the last ten years reflects the consequences of the period of stress experienced by financial institutions in Colombia between 1997 and 1999, which led to bank failures, acquisitions and merges among financial institutions⁶.

The macroeconomic variables used were taken from several sources: International Financial Statistics data was used for CPI and bilateral exchange rate peso-US dollar for both countries. As a proxy of GDP, which is not available on a monthly basis, the *Estimador Mensual de Actividad Económica Index* (EMAE) without seasonality was used for Argentina, and the *Índice de Producción Real Manufacturera* (IPM) for Colombia. The first one is available online in a monthly frequency from *Instituto Nacional de Estadísticas y Censos of Argentina* (INDEC), while the second one is available online at the Central Bank of Colombia's (BANREP) web page.

⁶ The way in which the *Superintendencia Financiera* handles acquisitions and merges is the following: when a big bank acquires a small bank (definition), the small bank disappears while the big bank's figures become those of the group; when a merge takes place, both banks disappear at the time of the merge, and a new one starts operating the period after.

The interbank interest rate is used as the monetary policy instrument. This variable was chosen, because it is the most commonly used in monetary transmission mechanism and inflation targeting studies (see, for example, Gómez and Julio, 2001). The interbank interest rate of Argentina is available online at the webpage of the Central Bank of Argentina (BCRA), and that of Colombia is available online at the webpage of BANREP.

3.2 Construction of variables

As a proxy of bank-specific characteristics, capitalization ratio and liquidity were used. All these variables were constructed from balance sheet data. The ratio of equity over assets was used as our measure of capitalization. Liquidity was measured as the ratio between liquid assets minus short-term liabilities *and* deposits (checking, savings and time deposits).

These variables are included to test whether bank specific variables affect lending, and whether banks with different characteristics respond differently to monetary policy shocks. According to the bank lending channel, capital market imperfections affect the relationship between banks and their investors. Therefore, it is expected that variables that proxy for the financial health of a bank, such as capitalization and liquidity, matter in these relationships.

3.3 Characteristics of the banking sectors in Argentina and Colombia

Tables 1 to 3 show summary statistics of characteristics of the banking systems in Argentina and Colombia at different points in time. These characteristics are presented in two ways: the first four columns in each table group banks according to asset size, while the last four group them according to the capitalization ratio. For instance, the fourth column “>75”, stands for the group composed by the 25 percent of the largest banks in terms of assets. Similarly, the eighth column, also labeled “>75”, stands for the group composed by the 25 percent banks with largest capitalization ratio.

According to Table 1, the best capitalized banks have significantly lower liquidity ratios. This can be explained by the fact that holding liquid assets has an opportunity cost which well capitalized banks need not incur.

It is also important to note that there are differences in the ratios of capitalization among groups of banks in Argentina. For instance, for November 2005, while the 25 percent least capitalized banks had a capital ratio of 5.6%, the top 25 percent had a capital ratio of almost 55%⁷. These differences are much

⁷ There is a caveat regarding the way capitalization is measured. Since it is calculated as equity over assets, and after the crisis of 2001-2002 the Central Bank of Argentina allowed the banks to choose the way in which they would account for the losses, some banks may have lower capitalization ratios even though they decided to account for all the losses early in 2002 or 2003, while others still have not accounted for all the losses due to the crises and default. This problem does not have a solution since the Central Bank of Argentina does not make this information public.

TABLE 1
CHARACTERISTICS OF THE BANKING SYSTEM IN ARGENTINA
(NOVEMBER 2005)

Characteristics	By Asset Size (percentile)				By Capitalization (percentile)			
	< 25	25-50	50-75	> 75	< 25	25-50	50-75	> 75
<i>Market Share (percent)</i>								
Total Assets	0.65	3.44	9.60	86.31	28.15	54.33	15.74	1.78
Total Loans	0.74	3.14	8.44	87.68	24.34	58.91	14.60	2.15
Securities	0.51	2.80	10.15	86.53	33.69	51.71	12.98	1.62
Deposits	0.21	3.16	9.20	87.44	24.08	64.03	11.36	0.52
<i>Ratios as group aggregate (percent)</i>								
Loans to Asset	41.16	33.15	31.88	36.86	31.36	39.34	33.66	43.89
Securities to Assets	23.29	24.06	31.18	29.58	35.30	28.08	24.33	26.91
Deposits to Liabilities	38.38	70.44	72.37	69.34	55.52	80.61	57.33	42.89
Capitalization	49.25	16.17	14.36	10.79	5.59	11.26	18.45	54.88
Liquidity	11.80	17.70	26.60	28.47	32.99	24.72	30.57	11.53
<i>In millions of pesos of November 2005</i>				<i>In millions of US dollars of November 2005</i>				
Total Assets of the system		208159		Total Assets of the system		70658		
Total Loans of the system		75522		Total Loans of the system		25636		
Total Securities of the system		61406		Total Securities of the system		20844		
Total Deposits of the system		133317		Total Deposits of the system		45254		
Number of Banks		72						

Source: Author's elaboration based on "Información de Entidades Financieras", Banco Central, Argentina.

stronger than those of banks in the US and other countries such as Colombia. It can also be observed that the group of more capitalized banks has a significantly lower ratio of deposits to liabilities. This can be explained by the fact that more capitalized banks have better access to alternative sources of funding, and therefore they depend less on deposits to finance their positions in assets.

As for Colombia, some important facts can be observed from Table 2. When looking at the differences according to size, it can be noticed that smaller banks tend to have a bigger participation of loans in their assets, vis-a-vis larger banks. Similarly, they have a smaller participation of securities. That trend explains the fact that smaller banks appear to have lower liquidity ratios than larger banks do. Similarly, the biggest banks have a high capitalization ratio, relative to the mean of the system. Equally as important, the banks in the smallest percentile are the less capitalized among commercial banks. Note also that banks of any size obtain their financing basically from deposits⁸.

⁸ Deposits include demand deposits as well as time deposits.

TABLE 2
CHARACTERISTICS OF THE BANKING SYSTEM IN COLOMBIA
(SEPTEMBER 2005)

Characteristic	By Size (percentile)				By Capitalization (percentile)			
	< 25	25-50	50-75	> 75	< 25	25-50	50-75	> 75
<i>Market Share (percent)</i>								
Total Assets	7.9	15.4	25.8	50.9	23.1	19.8	10.7	46.4
Total Loans	9.5	17.6	24.3	48.7	22.4	19.9	12.3	45.4
Securities	5.9	11.7	29.5	52.9	24.2	19.9	8.0	47.9
Deposits	7.5	15.9	26.7	49.9	23.1	20.4	11.0	45.5
<i>Ratios (percent)</i>								
Loans to Assets	62.6	59.2	49.0	49.8	50.4	52.3	59.9	50.9
Securities to Assets	25.3	25.6	38.7	35.2	35.5	34.0	25.3	34.9
Deposits to Liabilities	75.8	85.9	84.6	81.4	79.0	84.2	84.5	83.1
Liquidity	15.9	24.8	41.4	37.8	36.2	36.1	24.1	36.8
Capitalization	8.8	12.7	10.8	12.1	7.9	10.7	11.9	13.8
<i>Participation of Total Loans (percent)</i>								
Commercial	52.4	51.1	60.5	70.7	56.5	57.8	52.4	71.5
Consumer	46.8	25.6	30.6	17.5	27.6	33.8	26.6	19.1
Mortgage	0.4	24.3	8.7	10.0	9.6	9.4	22.1	10.0
<i>In millions of Colombian pesos of November 2005</i>								
Total Assets of the system	110,231,651				<i>In millions of US dollars of November 2005</i>			
Total Loans of the system	57,357,481				Total Assets of the system			
Total Securities of the system	37,273,492				Total Loans of the system			
Total Deposits of the system	80,323,813				Total Securities of the system			
					Total Deposits of the system			
					47,690			
					24,815			
					16,126			
					34,721			
Total Number of Commercial Banks	21							

Source: Author's elaboration based on monthly report of Superintendencia Financiera de Colombia.

Meanwhile, when looking at the characteristics of banks according to their capitalization ratio, trends seem to be less clear. The most capitalized banks (those above the 75th percentile) are also the biggest ones, according to market shares. But, for lower percentiles, there is no clear relationship between size, as proxied by market shares, and the degree of capitalization. More importantly, when dividing banks according to the capitalization ratio, there does not appear to be a pattern in asset composition; the percentage of loans to total assets are very similar among groups, as well as the percentage of securities. But, what can be observed is that the most capitalized banks have a larger proportion of commercial loans and a smaller participation of consumption loans.

Nevertheless, banks' characteristics in Colombia appear to have changed over time. Table 3 replicates the information shown in Table 3 for December

1996. By the end of 1996, there was a negative relation between capitalization and the ratio of loans to assets; while banks in the first quartile according to capitalization had a ratio of loans to assets above 75%, the quartile of the most capitalized banks had a ratio below 60%. Correspondingly, the ratio of securities to assets had a positive relationship with the degree of capitalization. When comparing asset composition between 1996 and 2005, it is noticeable that, in general, banks turned to have more securities and fewer loans in their portfolios after the crisis. Note that the ratio of loans to assets reduced importantly for all groups of banks, while the ratio of securities to assets rose significantly. This can probably be explained by the systematic default of banks that took higher risks in the period of credit boom before the crisis, and by more conservative lending

TABLE 3
CHARACTERISTICS OF THE BANKING SYSTEM IN COLOMBIA
(DECEMBER 1996)

Characteristic	By Size (percentile)				By Capitalization (percentile)				
	< 25	25-50	50-75	> 75	< 25	25-50	50-75	> 75	
<i>Market Share (percent)</i>									
Total Assets	4.6	11.8	28.8	54.8	31.8	15.5	25.2	27.4	
Total Loans	4.7	11.2	29.6	54.5	36.8	16.5	22.7	24.0	
Securities	4.2	12.1	25.7	58.0	15.3	11.1	29.6	44.0	
Deposits	4.0	11.6	31.1	53.3	38.7	16.8	22.8	21.8	
<i>Ratios (percent)</i>									
Loans to Assets	66.4	62.2	67.4	65.2	75.7	69.8	59.1	57.2	
Securities to Assets	10.4	11.9	10.3	12.1	5.5	8.3	13.5	18.5	
Deposits to Liabilities	69.4	78.9	81.9	82.8	93.1	86.3	73.6	70.5	
Liquidity	8.8	9.4	9.7	10.7	4.0	7.1	11.7	19.5	
Capitalization	14.8	13.6	12.2	13.6	5.9	10.5	15.0	21.9	
<i>Participation of Total Loans (percent)</i>									
Commercial	82.5	70.5	40.9	49.7	26.5	44.8	71.6	73.0	
Consumer	17.5	28.9	19.7	14.6	5.7	22.4	28.1	23.7	
Mortgage	0.0	0.6	39.4	35.7	67.8	32.8	0.3	3.3	
<i>In millions of Colombian pesos of November 2005</i>				<i>In millions of US dollars of November 2005</i>					
Total Assets of the system	94,962,893			Total Assets of the system					53,207
Total Loans of the system	62,216,689			Total Loans of the system					34,859
Total Securities of the system	10,956,440			Total Securities of the system					6,139
Total Deposits of the system	65,782,971			Total Deposits of the system					36,858
Total Number of Commercial Banks	40								

Source: Author's elaboration based on monthly report of Superintendencia Financiera de Colombia.

policies taken by surviving banks that tend to account better for risks coming from the lending business.

Another important feature, now regarding liability composition, is that more capitalized banks in 1997 tended to have a lower ratio of deposits to total liabilities than less capitalized banks. This seems to provide some indirect evidence of the presence of capital market imperfections for banks, as predicted by the bank lending channel theory, and also of the importance of the capitalization ratio as an indicator of the degree of informational asymmetries faced by banks. Basically, the fact that there is a negative relation between the degree of capitalization and the ratio of deposits to liabilities supports the idea that better capitalized banks are less deposit-dependent, in the sense that they can find easier substitutes for these than less capitalized banks do. Nevertheless, this relationship tended to disappear in time, becoming less clear in recent years. This could have happened because the differences in capitalization between different groups of banks has reduced, due to failure of poorly capitalized banks and also to financial decisions taken by surviving banks.

As a final point concerning the evolution of the banking sector characteristics in time for Colombia, it is important to mention that more capitalized banks appear to have a larger proportion of commercial loans in their portfolios. This could suggest that banks that lend to large firms are healthier and better capitalized banks.

One can observe several differences for Argentina and Colombia from Tables 1 to 3. One is that the banking system of Argentina is much more concentrated than that of Colombia. For example, while the largest banks in Argentina hold 86% of the assets of the system, that figure is 51% for Colombia, even though the number of commercial banks in Argentina is more than three times that of Colombia. Next, the capitalization ratios for Argentina are much higher than those for Colombia, especially in recent years. Also, banks in Argentina with the highest capitalization ratios are small banks in terms of asset size, whereas in Colombia, those with the highest capitalization ratios are big banks in terms of asset size.

3.4 Evidence of a Bank Lending Channel in other Countries

Kashyap and Stein (1995) use quarterly data on banks operating in the United States from 1976.1 to 1992.2. They classify banks by their asset size and use the Fed Funds rate as the monetary policy instrument. They find that a tightening in monetary policy declines deposits for all size categories and in a similar fashion. They find evidence of a bank lending channel for all but the biggest asset size category –that is, increases in the Fed funds rate has a negative and statistically significant effect on the growth rate of total loans. If instead of total loans, C&I loans are used, they find similar results. They also find that small bank securities holdings are more sensitive to changes in monetary policy, although they recognize that the results they get are not as clear as with growth rate of loans.

Kishan and Opiela (2000) also provide evidence that support the existence of a bank lending channel in the United States. They use quarterly data from 1980.1 to 1995.4 for 13042 commercial banks and divide banks according to their size and capital adequacy. They find that loans of small undercapitalized banks are more responsive to monetary policy. They also find that large time deposits of small undercapitalized banks are unresponsive to monetary policy. They conclude that the asset size and the capital ratio have important implications for the strength and distributional effects of monetary policy and for the relation between stabilization and regulatory policy.

Altunbas *et al.* (2002) use yearly balance sheet data to estimate the response of monetary policy stance between 1991 and 1999 for countries in the European Monetary Union (EMU). They classify banks according to asset size and capital and find that undercapitalized banks of any size tend to respond more to changes in monetary policy when they use the pooled data on the eleven EMU countries. When they look at individual country estimates for France and Germany they do not find evidence supporting a bank lending channel, but they do find evidence for Italy and Spain. In Spain, they find some evidence that a bank lending channel exists for the largest undercapitalized and adequately capitalized banks. In Italy, they find some evidence of a bank lending channel for adequately capitalized and overcapitalized banks. They conclude that more research is needed to further investigate bank lending channels in the smaller EMU countries and that balance sheet data availability should be improved and different model specifications should be used –i.e., more indicators of monetary policy stance and different lag structures.

Alfaro *et al.* (2005) use quarterly data from 1990.1 to 2002.2 and find evidence supporting a bank lending channel in Chile with a significant impact on macroeconomic activity. The evidence of a bank lending channel is more important for banks with low liquidity ratios and to lesser extent smaller and less capitalized banks.

4. EMPIRICAL RESULTS

The empirical specification in this panel approach is the following:

$$(15) \quad y_{it} = \sum_{j=1}^6 X_{it-j} \beta_j + \sum_{j=1}^6 x_{3it-j} I_2' \odot Z_{it-1} \phi_j + \alpha \text{Dummycrisis}_t + u_{it}$$

where y_{it} represents the growth rate of total loans for bank i at time t ; X is a matrix of macroeconomic variables including a proxy for the growth rate of GDP, growth rate of real exchange rate and the policy instrument, which is the real interbank interest rate (denoted by x_{3it} and calculated as the nominal interbank interest rate minus observed monthly inflation rate). Z is a matrix of bank specific variables, namely, capitalization and liquidity. Monthly dummies

to control for seasonality in the data were also included; *Dummycrisis* is a dummy variable included for Colombia to control for the financial crisis period between July 1998 and December 2000. $1_2'$ is a 2×1 row vector of ones and “ \odot ” is the Hadamard product. The error term was assumed *i.i.d.* as well as to account for bank specific AR(1) structure. For Colombia, another two regressions are considered, namely, one for commercial loans and one for consumer loans.

The estimated empirical specification for both countries is

$$(16) \quad \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{pmatrix} = \begin{pmatrix} X_1^* \\ X_2^* \\ \vdots \\ X_m^* \end{pmatrix} \delta + \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_m \end{pmatrix}$$

where 1, ..., m are the banks and the X^* matrix contains all the variables in the Right Hand Side of (15)

$$E(u u') = \begin{pmatrix} \sigma_{1,1}\Omega_{1,1} & \sigma_{1,2}\Omega_{1,2} & \cdots & \sigma_{1,m}\Omega_{1,m} \\ \sigma_{2,1}\Omega_{2,1} & \sigma_{2,2}\Omega_{2,2} & \cdots & \sigma_{2,m}\Omega_{2,m} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{m,1}\Omega_{m,1} & \sigma_{m,2}\Omega_{m,2} & \cdots & \sigma_{m,m}\Omega_{m,m} \end{pmatrix}$$

As a robustness test, the variance structure of the errors was also specified to account for autocorrelation of order 1 specific to each panel⁹.

The results for Argentina suggest that there is no direct bank lending channel triggered by changes in the interbank interest rate. But there is indirect effect on bank lending through the interactions of the interbank interest rate and capitalization and, to a less extent, liquidity.

These results suggest that when the interbank interest rate changes, the growth rate of loans will be affected less the better capitalized (and the higher its liquidity ratio) the bank is.

⁹ Some studies have used dynamic panel data models to look for evidence of a bank lending channel. However, since the endogenous variable is the growth rate of loans, it is not clear why the growth rate of loans of today depending on its previous realizations. The current period growth rate of loans might depend on past periods realizations through demand side influences, but these should be captured by the macroeconomic and bank specific variables.

TABLE 4
TOTAL EFFECT COEFFICIENTS FOR ARGENTINA
DEPENDENT VARIABLE: GROWTH RATE OF TOTAL LOANS

<i>Variable</i>	<i>Coefficient</i>	<i>Std.Err</i>
Interbank rate	-0.032	0.022
Interactions:		
Interbank rate x Liquidity	0.048**	0.015
Interbank rate x Capitalization	0.143*	0.025

*, ** Significant at the 1 and 10 percent level.

The results for Colombia agree with the basic ideas of the bank lending channel. See Tables 5 and 6, which show the results of the regressions corresponding to total loans and commercial loans. Note that the impact of monetary policy on the growth rate of loans is negative; increments in the interbank interest rate lead to reductions in the growth rate of loans. However, the impact is not the same across banks; those institutions that have lower capitalization and liquidity ratios are affected more.

This suggests that these bank specific variables, capitalization and liquidity, affect lending decisions done by banks, and also the ability that they have to obtain alternative sources of funding when a monetary policy shock affects the amount of core deposits in the economy. The interpretation of the coefficient on the interaction terms is the following: when the interbank rate goes up by one percentage point (*i.e.* from 6 to 7 percent), there is a direct effect on total loans, that according to Table 5 will fall by 0.68 percent. But the more capitalized a bank is, the smaller the fall in deposits will be. For example, total loans a bank with a capitalization of 0.10 will fall by $0.6824 - 4.542 * 0.10 = 0.228$, while a bank with capitalization ratio of 0.15, the fall will be of smaller magnitude, in fact negligible: $0.6824 - 4.542 * 0.15 = 0$.

The results are quite different when the growth rate of consumption loans is used in the regressions. The interest rate is not significant in explaining changes in the growth rate of these loans, and bank specific variables do not appear to matter either. This result suggests that consumer loans have a different dynamics than commercial loans. However, as it was before seen, commercial loans represent the great majority of total loans, and that can explain that even when there is no evidence of a bank lending channel for consumer loans, there is evidence for total loans.

TABLE 5
TOTAL EFFECT COEFFICIENTS FOR COLOMBIA
DEPENDENT VARIABLE: GROWTH RATE OF TOTAL LOANS

<i>Variable</i>	<i>Coefficient</i>	<i>Std.Err</i>
Interbank rate	−.6824*	0.0551
Interactions:		
Interbank rate x Liquidity	1.6949*	0.1379
Interbank rate x Capitalization	4.5424*	0.3608

* Significant at the 1 percent level.

TABLE 6
TOTAL EFFECT COEFFICIENTS FOR COLOMBIA
DEPENDENT VARIABLE: GROWTH RATE OF COMMERCIAL LOANS

<i>Variable</i>	<i>Coefficient</i>	<i>Std.Err</i>
Interbank rate	−0.6710*	0.0757
Interactions:		
Interbank rate x Liquidity	1.5629*	0.1892
Interbank rate x Capitalization	4.7544*	0.4947

* Significant at the 1 percent level.

5. BANK LENDING CHANNEL FOR COLOMBIA USING FIRMS' DATA

As a robustness test for the evidence of bank lending channel for Colombia, we analyze balance sheet data for Colombian firms. In order to identify the bank lending channel with these data, we separate firms into two groups according to the degree of leverage¹⁰. Group 1 is composed by firms in the lowest quartile of leverage and Group 2 is composed by firms in the highest quartile. The intuition behind this way of grouping firms is that in moments of tight monetary policy, firms with higher indebtedness will find it harder to obtain liquidity. Therefore, the impact of a change in interest rates on these firms should be stronger than on those with lower leverage ratios.

Kashyap *et al.* (1993) developed a simple theoretical framework to model changes in optimal debt structure of the firm over time. In times of contractionary monetary policy, bank loans experience a supply shock due to the fall in deposits.

¹⁰ Leverage is defined as the ratio of total liabilities to total assets of the firm, following the conventional definition.

As the spread between the interest rates on bank loans and non-bank debt rises, the lending channel would anticipate a decrease in bank lending in the firm's optimal debt structure. Furthermore, as risk increases in periods of contractionary monetary policy, banks will be more reluctant to lend to firms with poor information availability.

5.1 Data Source

The data for firms was collected by the *Superintendencia de Sociedades*, the organism that regulates non-financial firms in Colombia. The sample consists of a panel of annual observations on firms from 1995 to 2004. For each year, more than six thousand firms submit information about their balance sheets. The panel is unbalanced, due to the entry and exit of firms, and also to the fact that some firms report their balances for some years but not for others (not necessarily for consecutive years).

After eliminating the data base for firms that have an early exit or a late entry, or that do not report for the whole span of time, we are left with a balanced panel of around four thousand non-financial firms belonging to various economic sectors.

5.2 Empirical Specification and Results

The empirical specification in this panel approach is the following:

$$(18) \quad BD_{it} = \sum_{j=1}^2 BD_{it-j} \gamma_j + \sum_{j=1}^2 \Delta \log(R_{t-j}) \theta_j + \sum_{j=1}^2 inv_{it-j} \eta_j + cap_{it-1} \mu + \alpha Dummycrisis_t + u_{it}$$

where BD_{it} represents the ratio of bank debt to total debt for firm i at time t ; R_t is the real interbank interest rate, which instruments for monetary policy; inv controls for inventories (the decision of increasing or decreasing inventories might affect the debt structure in the margin) and cap for capitalization. The parameters of interest are γ , θ , η and μ ; in particular, the vector θ , which multiplies the instrument for monetary policy. *Dummycrisis* is a dummy variable included for Colombia to control for the financial crisis period of 1999 and 2000. The error term is assumed *i.i.d.*

Because lag values of the dependent variable are included as regressors, we use Arellano and Bond (1991) methodology, which corrects the inconsistency of the within estimator and provides a consistent and efficient estimator. The intuition of including lags of the ratio of bank debt as covariates is that the ratio presents some inertia over time, in the sense that the debt structure of firms does not change significantly in short periods of time.

The main results are summarized in Table 7, which presents the long run coefficients of the real interest rate for both groups of firms.

As shown in Table 7, the ratio of bank debt to total debt of both groups of firms goes down when the real interest rate increases. This is due to both supply

TABLE 7
EVIDENCE OF BANK LENDING CHANNEL FOR FINNS
DEPENDENT VARIABLE: RATIO OF BANK DEBT TO TOTAL DEBT

Group 1: Low-Leveraged Firms

<i>Variable</i>	<i>Coefficient</i>	<i>Std.Err.</i>
Interbank rate	-0.0068*	0.0037

* Significant at the 10 percent level.

Group 2: High-Leveraged Finns

<i>Variable</i>	<i>Coefficient</i>	<i>Std.Err.</i>
Interbank rate	-0.0191*	0.0068

* Significant at the 1 percent level.

and demand factors and debt substitution. However, the impact is clearly bigger and more significant for high leveraged firms than for low leveraged firms. This provides some additional support for the existence of a bank lending channel of monetary policy in Colombia.

6. CONCLUSION

In this paper we find empirical evidence of bank lending channel for Colombia. As for Argentina, we do not find evidence that changes in the interbank interest rate affect the growth rate of total loans directly. It does, however, indirectly through interactions: the interbank interest rate affects the loan supply through its interactions with capitalization and liquidity. As for Colombia, there is direct bank lending channel, which is reinforced through interactions with capitalization and liquidity.

Bank specific variables are key in analyzing how changes in the interbank rate affect the growth rate of loans for Argentina and Colombia. It is particularly important the way in which capitalization affects the lending ability of banks; better capitalized banks should be able to lend more in moments of constrained liquidity. This might be the result of a combination of minimum capital regulations and informational frictions in markets for banks' funds, which affect both the decisions taken by banks and their ability to raise funds in markets alternative to the deposits one.

Finally, using a panel data of more than 3300 firms, we provide additional support to the existence of a bank lending channel for Colombia.

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